

## **CLAIMS:**

1. An arrangement for feeding a mixture of bitumen and steam to a reactor for further processing of atomized bitumen within the reactor comprising:

5 an atomizing nozzle connected to a wall of said reactor and opening to an interior of said reactor, said nozzle being adapted to atomize bitumen carried by steam into droplets suitable for such further processing;

a main conduit having a main axis, connected at a proximal end to said nozzle and including openable closure means at a distal end thereof;

10 a first feed conduit having a first axis and connected to a source of bitumen, said first conduit being in a first plane containing said main and first axes, said first feed conduit joining said main conduit at an angle in the range of 30° to 60° as defined between said main and first axes downstream of the junction between said main and first conduits;

15 a second feed conduit having a second axis and connected to a source of steam, said second conduit being in a second plane containing said main and second axes, said second feed conduit joining said main conduit downstream of the junction between said main and first conduits at an angle in the range of 20° to 40° as defined between said main and second axes downstream of the junction between said main and second conduits; and

20 flow-accelerating nozzle means positioned in said second feed conduit upstream of the juncture between said main and second conduits.

2. The arrangement of claim 1 wherein said first and second planes are coplanar, with said first and second feed conduits being positioned on opposite sides of said main conduit.

25 3. The arrangement of claim 1 wherein said first and second planes are separated angularly by an angle in the vicinity of 90°.

30 4. The arrangement of claim 1 wherein said flow accelerating nozzle means is positioned in said second feed conduit adjacent the junction of said second feed conduit with said main conduit.

5. The arrangement of claim 1 wherein said angle between said main and first axes is about 45° and the angle between said main and second axes is about 30°.

5 6. The arrangement of claim 1 wherein said closure means is adapted to receive an elongated pusher rod therethrough, which rod is adapted for pushing any bitumen that might clog said main conduit through said main conduit and said atomizing nozzle into said reactor.

10 7. The arrangement of claim 1 wherein said main conduit has a diameter of about 38mm, said first feed conduit has a diameter of about 38mm, said second feed conduit has a diameter of about 24mm, and said first axis intersects said main axis at a point about 23mm upstream of a point at which said second axis intersects said main axis.

15 8. The arrangement of claim 7 wherein said flow accelerating nozzle has a minimum diameter of about 10mm

9 The arrangement of claim 1 wherein said main conduit has a diameter  $D_1$ , said first feed conduit has a diameter  $D_2$ , said second feed conduit has a diameter  $D_3$ , and wherein  $D_1$  is substantially equal to  $D_2$ , and  $D_3$  is about 60% to 65% of  $D_2$ .

20 10. The arrangement of claim 1 wherein said flow-accelerating nozzle has a diameter selected to impart a mean gas velocity of at least 24.4 m/sec to steam exiting therefrom.

25 11. The arrangement of claim 9 wherein said flow-accelerating nozzle has a diameter  $D_4$  which is about 42% of the diameter  $D_3$  and wherein said diameter  $D_4$  is also selected to impart a mean gas velocity of at least 24.4 m/sec to steam exiting therefrom.

12. The arrangement of claim 1 wherein said closure means is adapted to be opened for insertion of conduit cleaning means into said main conduit.

5 13. A mixing arrangement for feeding a mixture of oil and steam to an atomizing nozzle connected to a reactor for further processing therein, comprising:

a main conduit having a main axis, for connection at a proximal end to said nozzle and including openable closure means at a distal end thereof;

10 a first feed conduit having a first axis and connected to a source of oil, said first conduit being in a first plane containing said main and first axes, said first feed conduit joining said main conduit at an angle in the range of 30° to 60° as defined between said main and first axes downstream of the junction between said main and first conduits;

15 a second feed conduit having a second axis and connected to a source of steam, said second conduit being in a second plane containing said main and second axes, said second feed conduit joining said main conduit downstream of the junction between said main and first conduits at an angle in the range of 20° to 40° as defined between said main and second axes downstream of the junction between said main and second conduits; and

flow-accelerating nozzle means positioned in said second feed conduit upstream of the juncture between said main and second conduits.

20 14. The arrangement of claim 13 wherein said closure means is adapted to be opened for insertion of conduit cleaning means into said main conduit.

25 15. A mixing arrangement for feeding a mixture of a heavier, generally incompressible, fluid and a lighter, compressible, fluid to a location for further processing therein, comprising:

a main conduit having a main axis, for connection at a proximal end to processing apparatus at said location;

a first feed conduit having a first axis and connected to a source of said heavier fluid, said first conduit being in a first plane containing said main and first axes, said first feed conduit

joining said main conduit at an angle in the range of 30° to 60° as defined between said main and first axes downstream of the junction between said main and first conduits;

a second feed conduit having a second axis and connected to a source of said lighter fluid, said second conduit being in a second plane containing said main and second axes, said second feed conduit joining said main conduit downstream of the junction between said main and first conduits at an angle in the range of 20° to 40° as defined between said main and second axes downstream of the junction between said main and second conduits; and

flow-accelerating nozzle means positioned in said second feed conduit upstream of the juncture between said main and second conduits.

16. The arrangement of claim 15 wherein said main conduit includes closure means at a distal end thereof, adapted to close said main conduit at said distal end and to open said main conduit for insertion of conduit cleaning means into said main conduit.

17 The arrangement of claim 15 wherein said main conduit has a diameter  $D_1$ , said first feed conduit has a diameter  $D_2$ , said second feed conduit has a diameter  $D_3$ , and wherein  $D_1$  is substantially equal to  $D_2$ , and  $D_3$  is about 60% to 65% of  $D_2$ .

18. The arrangement of claim 15 wherein said flow-accelerating nozzle has a diameter selected to impart a mean gas velocity of at least 24.4 m/sec to lighter fluid exiting therefrom.

19. The arrangement of claim 17 wherein said flow-accelerating nozzle has a diameter  $D_4$  which is about 42% of the diameter  $D_3$  and wherein said diameter  $D_4$  is also selected to impart a mean gas velocity of at least 24.4 m/sec to lighter fluid exiting therefrom.